well as in function, and illustrating his positions by a variety of experiments, which, with their results, are given at length in this paper; and after showing the practical applications of which the investigations contained in it are susceptible, he concludes by observing, that a just estimate of their importance can scarcely be formed, till an analogous account of the nerves of the throat, neck, and chest shall be laid before the Society, which will show that in them also there are the same distinctions of structure and functions, and that the nerves of respiration may be distinguished and separated amidst the apparent intricacy of the general system, and that by dividing them, the motions of the several parts, which unite in the act of respiration, may be successively stopped; while their other functions, dependent upon their other nerves, are continued.

By pursuing this investigation, the remaining parts of the nervous system are also much simplified, and the apparent confusion arising out of the crossing and re-union of nerves is thus shown to be for the purpose of associating the muscles into different classes, for combining them in subserviency to different organs, and placing them under the guidance of a sensibility more certain in its operation than the will.

Further Researches on the Magnetic Phenomena produced by Electricity; with some New Experiments on the Properties of Electrified Bodies in their Relations to Conducting Powers and Temperature. *By Sir* Humphry Davy, *Bart. P.R.S.* Read July 5, 1821. [*Phil. Trans.* 1821, *p.* 425.]

In this paper Sir Humphry Davy adds to his former details upon the subject of electro-magnetism, by tracing the general effects of the action of electricity on conductors, in their relation to this new property and to heat.

The magnetic phenomena he found the same, whether the electricity was small in quantity, and passing through good conductors of great magnitude, or whether the conductors were so imperfect as only to convey a small quantity of electricity. That these magnetic powers are not affected by the mobility of the parts of fluids, Sir Humphry proved by the electrization of mercury and fusible metal, in glass tubes, which were thus made to attract iron filings and magnetic needles, while imperfectly conducting fluids did not, under similar circumstances, give any polarity to steel. Electricity passed through air, however, produces this effect; and Sir Humphry has succeeded in affecting the arc of fire by the approximation of a magnet.

In investigating the relative conducting powers of substances for electricity, Sir Humphry found that a wire kept cool is a better conductor than when heated; and the knowledge of this fact led to the explanation of a very singular result, namely, that by applying heat to one part of a wire in the circuit, its other parts become colder, and that by applying cold they become hotter; thus, when one part

of a wire, heated to dull redness in the circuit, is cooled by ice, the remaining portion becomes white hot, whilst the application of the flame of a spirit-lamp renders the other part colder.

In discussing the relations of heat, magnetism, and chemical action, to electricity, Sir Humphry particularly adverts to the relative elevations of temperature which the different metals undergo during the transmission of electricity: thus, when a chain, composed of alternate lengths of silver and platinum is made the connecting medium between the poles of a powerful battery, the silver wire being four or five times the diameter of the platinum, the former metal is not sensibly heated, whilst the latter becomes intensely ignited. Now if heat be regarded as *material*, we cannot suppose that it is expelled from the platinum because it may be thus generated indefinitely; again, if dependent upon, or identical with, electricity, its quantity should be similar throughout the metallic chain. In regard to the magnetism of this chain, the case is different, for every part of it exhibits equal magnetic powers; so that the power appears directly as the quantity of electricity.

Sir Humphry Davy concludes this communication with some general remarks respecting the different phenomena produced by the agency of electricity; whether they depend upon one or more species of ethereal matter, or whether they are merely exhibitions of the attractive powers and subtile motions of the corpuscles of common matter, are questions which remain for the determination of future researches and experiments.

The Bakerian Lecture. An Account of Experiments to determine the Amount of the Dip of the Magnetic Needle in London, in August 1821*; with Remarks on the Instruments which are usually employed in such Determinations. By Captain* Edward Sabine, *of the Royal Regiment of Artillery, F.R.S.* Read November 22, 1821. [*Phil. Trans.* 1822, *p.* 1.]

After describing the imperfections of the instruments in general use for ascertaining the dip of the magnetic needle, and adverting to the consequent inaccuracy and insufficiency of the observations made with them, Captain Sabine gives an account of the form of dipping-needle which he preferred for his experiments, and which was constructed for him by Mr. Dollond, upon principles laid down by Professor Meyer, of Gottingen. He then enters into minute details of the mode of pursuing and verifying his observations, the results of which, gained by three different methods, are as follows: viz. by 10 experiments with Meyer's needle, 70° 2′·9; by the times of oscillation in the magnetic meridian, and in the plane perpendicular to it (mean by three needles), 70° 04′; by the times of vertical and horizontal oscillation, 7° 02′·6. So that 70° 03′ may be considered as the mean dip of the needle towards the north, in August and September 1821, within four hours of noon, being the limit within which all the experiments were made.